The Importance of Zoos: A three-fold look at Conservation, Education and Animal Husbandry in AZA-accredited Zoological Facilities

An Honors Thesis (HONR 499)

By

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Abstract:

Zoological facilities accredited by the Association of Zoos and Aquariums (AZA) play an important role in society. They provide a positive animal experience for guests while also offering a safe and healthy home to animals that would not otherwise be able to survive. AZA zoos and aquariums work tirelessly to further conservation both at the zoo and abroad, protecting and preserving the natural environment. Aquariums and zoos offer unique educational experiences, informing the public about animals, the ecosystem, and the threats that endanger our natural world. While aiding conservation and educating millions of visitors each year, AZA zoos and aquariums also provide exemplary care for the animals at the zoo through regulated animal husbandry practices. Through conservation, education, and animal husbandry zoological facilities demonstrate their importance, not just to the animals that rely on them, but to the general public and to the health of our natural world.

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Thank you to everyone who has supported me on my journey to becoming who I am today. To my mother, Michele Richardson, who has always been there and continues to be my biggest supporter as I embark on the great adventure that is life, and my continuing goal of becoming a zookeeper.

Forward:

I have always loved animals and have known from a very young age that I wanted to dedicate my life to protecting and caring for those animals. I decided a long time ago that the way in which I wanted to accomplish this goal was by becoming a zookeeper. As a zookeeper I would be able to work in an accredited zoo to provide excellent care for a variety of both exotic and native species, while still being able to share my passion for animals with those around me. Zoos are the perfect place for me to share my love and passion for animals with visitors. It is my goal to help animals touch the hearts and souls of anyone who comes to visit the zoo. Inspired by amazing, dedicated conservationists such as Steve Irwin and Chris and Martin Kratt I know that I will never change the world or touch the hearts of millions like they did, but if I can show even one person how amazing and beautiful animals are, to help them see that animals are not scary or violent beasts bent only on destruction, then my life will be complete. In the immortal words of Steve Irwin, "If there is one thing I would want to be remembered for it's passion and enthusiasm. Conservation is my job, my life, my whole being."

As someone who has dedicated her life to saving animals and educating people about them, it's understandably hard to constantly be told by people who love or hate animals alike, that they disagree with zoos. That they thinks zoos are sad places where the animals are mistreated, that zoos are unnecessary, or that the animals are better off in the wild. Well, the wild is disappearing. Human expansion, pollution, deforestation, and poaching are destroying the natural world. The only regions that can really still be considered "wild" are Antarctica, and parts of the

Amazon and Africa. People want to leave animals in the wild, but there is almost no wild left. That is why we need zoos, to protect the world and preserve nature and the animals that live in it.

Zoos work hard to protect and care for animals. Association of Zoos and Aquarium (AZA) accredited zoological facilities have amazing conservation and education programs to protect and preserve nature while helping to educate and create the next generation of conservationists. They also have strong animal husbandry policies to ensure that all animals in AZA facilities receive the best possible care imaginable. It is my hope that this paper, my senior thesis, will help to inform curious minds on the importance of zoos.

Sincerely,

Jennifer Richardson

The Importance of Zoos: Partner in Global Conservation

Every year more species become listed as threatened, a category that includes critically endangered, endangered, and vulnerable species. Currently the International Union for the Conservation of Nature (IUCN) lists 7,713 vertebrate species as threatened. Invertebrates, plants, and protists add an additional 15,071 threatened species to that list (IUCN 2015). These species edge closer to extinction every day with 77 species of modern mammals and 140 species of birds already extinct (IUCN^2 2015). As we constantly discover and lose more species, it makes estimating extinction rates difficult but the current rate suggests extinction is occurring at a rate on the order of 100 to 1000 what the extinction rate was prior to human's dominance of the planet (Vitousek et al. 1997). As a species, humans are destroying the Earth—overfishing the oceans, using excessive fuel, polluting the atmosphere, destroying the rainforests; its all been heard before, but not everyone listens. In a struggle to survive, the planet is losing. It's now up to humans to actively work against the damage we have done (Marshall 1994).

It is here that we turn to zoos. Zoos set an example of conservation and educate people on what they can do to help. Conservation starts with just one person deciding to make a difference. It can be something as small as planting flowers in a garden to help the declining honeybee and monarch butterfly populations (Cane and Tepedino 2001), or it can be a much larger project like the current program sponsored by the Association of Zoos and Aquariums (AZA). AZA SAFE (Saving Animals From Extinction) is a new strategic plan that is implemented

across the entire AZA-accredited community. The goal of the program is to involve all 229 AZA-accredited facilities, as well as the over 180 million visitors who frequent those zoos and aquariums, in conservation science. This year, in 2015, SAFE will focus on 10 species: African penguins (*Spheniscus demersus*), Asian elephants (*Elephas maximus*), Black rhinoceros (*Diceros bicornis*), Cheetahs (*Acinonyx jubatus*), Gorillas (*Gorilla gorilla, G. beringei*), Sea turtles, Sharks, Vaquitas (*Phocoena sinus*), Western pond turtles (*Actinemys marmorata*), and whooping cranes (*Grus americana*) (AZA 2015). These programs will focus on protecting and preserving threatened species with the goals of saving those animals from extinction.

There are an estimated 7,500 cheetahs left today, roughly half of the population that existed in 1975. They are constantly threatened by political instability, habitat loss, and conflict with farmers and ranchers. Cheetahs have disappeared from 76% of their historic range and their genetic diversity continues to decrease with an estimate that less than half the population of wild cheetahs actually contributes to the gene pool (AZA 2015). The AZA SAFE program is working to help protect the cheetah population. In August of 2014, program leaders from the Cheetah Species Survival Plan and Taxon Advisory Group met in Johannesburg, South Africa with representatives from the Field Conservation Committee, and the Range Wild Conservation Program for Cheetah and African Wild Dogs (RWCP) as well as dozens of other government and conservation personnel to create a 3-year plan of action for Cheetah Conservation. Topics included the illegal trade of

cheetahs, human conflict, and other threats to cheetah populations. The goal was to create a plan to help save cheetahs from extinction.

In March of 2015, the plan took another step by sponsoring a field-training course in Central Africa. This course provided vital training in the field, skills such as tracking, camera trapping, and scat identification. This training increased the number of individuals who are trained in the field techniques necessary to be able to implement the National Action Plan for cheetah conservation (AZA 2015). These actions help to protect and preserve the wild Cheetah, but Cheetah conservation extends inside zoo facilities, as well. Since 1956, the African cheetah has been breed in North American Zoological facilities. They are a hard species to successfully breed but thanks to many North American zoos, as well as the London Zoological Society and the DeWildt Cheetah Breeding and Research Center in South Africa, successful breeding programs have been developed over the last few decades (Marker and O'Brien 1989). These breeding programs offer hope for the future of the cheetah population, pointing toward hope for the species as a whole.

Similar steps are being taken for each of the ten species at the current focal point of SAFE. The African Penguin SAFE Conservation Action Plan focuses mainly on developing artificial nests for the colonies and facilitating long-term monitoring of breeding colonies. After the large-scale collection of guano for use as fertilizer, the penguin population plummeted drastically. African penguins use guano to line and build their nests. The over collection of guano impacted the nesting and breeding behaviors of penguins, causing the crash of the breeding population (Roach 2004). Oil spills have also resulted in significant penguin mortality. The oil destroys feather

quality and waterproofing, as well as tainting the penguins' main food sources. The SAFE program will not only monitor the population's numbers, foraging and breeding behaviors but also the state of the environment and provide disaster relief after oil spills, with special focus on the rescue and rehabilitation of the colonies (AZA 2015).

AZA members have been working for years to further conservation and SAFE will allow all the zoos to become more involved in worldwide conservation efforts. In the last three years alone, 20 AZA zoos and aquariums donated approximately $95,000 to African penguin conservation while 24 AZA-accredited institutions spent $1.3 million dollars in black rhinoceros conservation (AZA 2015). These examples barely even scratch the surface in terms of zoo involvement in conservation. The World Association of Zoos and Aquariums (WAZA) contribute approximately $350 million yearly to conservation across the world, making them the third largest contributor to conservation worldwide (Conde et al. 2011). Zoos and Aquariums facilitate thousands of conservation projects and initiatives focusing on species in all parts of the globe.

The field conservation assisted by zoos is invaluable to animal conservation, but *ex situ* conservation is also necessary. For this, captive breeding, like the Species Survival Plan (SSP) program, is necessary. The International Species Information System (ISIS) database holds comprehensive information regarding the animals held in zoos and aquariums worldwide. This allows the populations and individuals in each population to be identified between institutions. Zoos and aquariums hold

roughly 15% of all threatened species, with an even higher percentage of threatened mammals living in zoos (Conde et al. 2011).

In 1981 the AZA, then the AAZPA (American Association of Zoological Parks and Aquariums), initiated the Species Survival Plan program (Marshall 1994). This was a program designed to work collectively with other zoos to protect animal populations and preserve genetic diversity. The goal is to save species from extinction through captive breeding programs. A group called the Taxon Advisory Group (TAG) manages SSPs through AZA. Each TAG is responsible for developing a comprehensive studbook for the population, as well as a breeding and transfer plan. The studbook lists all individuals in the population at all AZA-accredited institutions and partner facilities. The studbook contains information about the individuals, as well as their locations and genetic histories. From this information, the breeding and transfer plans can be made. The breeding and transfer plans are a list of suggested animal parings and moves between institutions. These suggested breeding pairs could then be approved and transferred, with the hope that they will mate successfully, bringing genetically diverse and strong young into the population.

The SSPs have different levels of involvement based on the projected sustainability of the population. SSPs are labeled as green (most sustainable), yellow, or red (least sustainable). Green SSPs are projected to retain at least 90% of their genetic diversity in 100 years, or 10 generations. Green programs are referred to as sustainable and participation in these programs is considered, if not mandatory, highly recommended. The Short-crested Rockhopper Penguin (*Eudyptes*

chyrsocome chrysocome) is an example of a Green SSP. Each plan has a coordinator and studbook keeper who works in the zoological field, managing the SSP on top of their other husbandry duties. The Short-crested Southern Rockhopper SSP is managed through the Milwaukee County Zoological Gardens, though multiple zoos send and receive information to take part in the SSP program.

Yellow SSPs have a lower projected genetic diversity and are considered potentially sustainable. Though not required, participation in yellow SSPs is suggested for involved institutions. Riverbanks Zoo Bird Keeper Melissa Reynolds works to manage the SSP and Studbook for Toco Toucans (*Ramphastos toco)*. She receives data about Toucan births and deaths from facilities around the nation, working to compile a plan that will allow zoos and their staff to transfer and pair the birds, striving to create a sustainable, genetically diverse population.

The red programs are less common and are deemed critical. These are populations that are already so low that it is unlikely that anything can be done to save them now. These programs are not officially considered to be Species Survival Plans.

The Species Survival Plan program offers many benefits. SSPs facilitate conservation, species recovery, and help to establish assurance populations. By having a sustainable population in captivity, even if those individuals are never deemed fit for release back into the wild, the species can still be saved from extinction with the hope that, if needed, those captive individuals might be able to restart the wild populations. SSPs also provide veterinary care for wildlife diseases,

helping to maintain healthy populations; all working toward the goal of having healthy, genetically diverse, demographically varied AZA populations.

Working with the smaller populations in captivity, it is easy for genetic diversity to become compromised. To prevent such occurrences, zoos and aquariums practice contraception with the animals. Non-breeding plans are created to couple with the breeding and transfer plans. The Wildlife Contraception Center (WCC) is based out of the Saint Louis Zoo in Saint Louis, Missouri. They limit the number of breeding recommendations not just on a basis of genetic diversity and compatibility, but also based on space. AZA facilities want to avoid having more animals born than can be properly cared for. The WCC helps prevent pregnancy by temporarily separating males from females or through the use of contraception.

With so many different animals under the care of AZA facilities, it made the most sense to establish a centralized facility with their own staff to monitor contraceptive use and recommend usage. In 1989, the first task force was created to study the use of contraceptives in zoos. This led to the creation of the WCC in 1999. Effectiveness of the methods and any potential side effects are closely monitored and contained within a large database containing over 30,000 records. To ensure the health and safety of the animals, the WCC is closely partnered with the Reproductive Health Surveillance Program at Michigan State University Veterinary School (Saint Louis Zoo 2015).

The Species Survival Plans and Studbooks are interdisciplinary, working across many different AZA facilities. Most zoos participate in individualized

conservation efforts as well. The San Diego Wild Animal Park in San Diego, California was designed to be a home for animals first, and an attraction for people on a secondary basis, when it opened in 1972. Today, the park provides a sanctuary for thousands of animals as well as rare plants. It is a successful research and breeding facility. As of 1994, of the fifty endangered species protected at the park, thirty-nine had been successfully bred, resulting in healthy young (Koebner 1994).

The Smithsonian Conservation Biology Institute replaced the former National Zoo's Conservation and Research Center in 2010. The former center chose animals to live there because the wild population was severely threatened, only a small captive population existed, or because the species proved difficult to breed in captivity (Koebner 1994). The purpose of the center was to preform research and implement breeding programs for the populations. They are a member of Conservation Centers for Species Survival, part of a group of five centers that work collectively to manage over 25,000 acres dedicated to studying and managing endangered species, with the goal for species recovery (Smithsonian National Zoological Park 2015).

Today, the Smithsonian Conservation Biology Institute (SCBI) is headquartered at the former facility in Front Royal, Virginia where it serves as the command center for their global efforts to conserve species and train the future generations of conservationists (Smithsonian National Zoological Park 2015). The SCBI helps coordinate and facilitate collaborative research initiatives including projects for amphibian and tiger conservation, as well as innovative projects to use

camera traps and aviation and aerospace technology to monitor and study animals in the wild. Researchers at SCBI were the first to identify and lead the research in elephant herpesvirus, a disease threatening elephant populations worldwide.

One of many zoos to perform animal conservation efforts, the SCBI takes a unique approach to conservation through their isolated research reserve. Other zoos participate in conservation efforts in the field or on the grounds of the zoo. Mystic Aquarium in Connecticut participates in field conservation including the behavioral ecology of Beluga Whales (*Delphinapterus leucas*) as a partner with Arctic Watch, as well as research and sustainable practices within their own zoo. These sustainable practices are also shared with their visitors so that guests can practice sustainable habits in their own lives (Grow et al. 2013). A full listing of conservation programs in AZA facilities can be found in the AZA annual report on Conservation and Science.

AZA accredited zoos and aquariums facilitate conservation every day. Through breeding programs, SSPs, and TAGs the zoos work to protect the species that live at their facilities. Through larger programs like SAFE, research, or global partnerships with other conservation organizations, zoos work to conserve the wild populations. Zoos and aquariums are among the largest contributors of global conservation worldwide, proving an invaluable source of animal conservation.

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The Importance of Zoos: Spreading Passion through Education

"In the end, we will conserve only what we love. We will love only what we understand. We will understand what we are taught" (Koebner 1994). This quote by the Senegalese conservationist, Baba Dioum, shows the importance of education. Zoos participate in hundreds of amazing conservation projects both locally and globally, but they can only do so much. If the rest of the world doesn't care about conservation, or about the animals and habitats that surround them, then we will never be able to save them. The best way to get people to care is to make them understand, to teach them about animals and about nature, and to share our passion for animals with the rest of the world. Zoos offer a teaching platform, a place where people can come and see animals up close. Visitors can watch the animals and learn about their behaviors. They can also read the informational signs posted about the animals, listen to keeper talks, or even take classes at the zoo.

Zoos educate visitors about the individual species in each exhibit, but they also have broader goals of education. Zoos go beyond the knowledge of species to a wider look at geography, environmental concerns, ecosystems, and conservation (Marshal 1994). AZA zoos and aquariums educate over 175 million visitors and 12 million students both in the classroom and in the field. They play a vital role in educating millions about wild animals and their habitats as well as conservation and how they can help preserve those species (AZA[2] 2015).

There are lots of different ways to foster education and learning, though. Animal exhibits include informational signs teaching about each species. Other signs and displays throughout the zoo focus on different messages of animal history,

conservation, and points of interest. Keeper talks about the animals offer another chance for education, especially in the case of feeding demonstrations and shows, such as those often seen with dolphins. Some zoos offer classes, ranging from classes that last only a few hours to an entire year taught on-grounds like the partnership between Grand Rapids Public Schools and John Ball Zoo in Grand Rapids, Michigan (GRPS 2015, Marshall 1994). Other zoos offer unique hands-on learning experiences. Each method offers its own educational benefits, and when combined, zoos and aquariums become hubs of life-long learning.

An integral part of any zoo's educational ability is through signs. Signs are the heart of all educational programs providing not just information but also entertainment and "visitor enrichment" (Sanctuary supplies 2007). Signs educate visitors about the animals they are looking at, usually containing the species name, both common and scientific, as well as information about the species. This information can vary between institutions but usually includes the conservation status of the species, its range, and facts about its behavior or lifestyle. Signs can be simple, like the signs for the small tanks in the Indianapolis Oceans building (Figure 1), containing just basic information about the species found in the tank. While simple, it still allows visitors to learn about the species and put a name with a face, so to speak. Other times, the signs contain much more in depth information, including a range map like the sign at the San Francisco Zoo in California (Figure 2).

Zoos don't just have signs for individual animals or exhibits, though. They also have signs that help visitors learn about conservation, or threats to the animals. These signs help the visitors get a more full experience at the zoo, teaching them

how interconnected the world is around them. A large sign, dominating much of one wall in the Indianapolis Zoo Oceans Building details how the actions of the visitors can affect the world's oceans (Figure 3). Rather than just looking at fish and feeling disconnected, these types of signs connect visitors to the world around them. Educational signs such as this connect the visitor to the idea of conservation and show how the actions of one species, including humans, affect the species around it.

The goal of zoo signs is to connect to the visitor and inform them about the animals on exhibit or about the natural world. Some signs do this through words, but others are more interactive, getting the guest involved. In the digital age, technology keeps getting better and better. Signs are no longer just a static image on a signpost. Signs can now be interactive, employing touch screen technology like the sign for Grant's Zebras at the San Francisco Zoo (Figure 2) or the monitors in the Oceans building at the Indianapolis Zoo that allow guests to take a survey about ocean conservation. Signs don't need to be digital to provide an interactive learning experience for guests, though. The Akron Zoo, in Akron, Ohio, has a sign near their tiger exhibit that is a tiger survival game (Figure 4). The sign allows guests to spin the wheel and experience the challenges and successes of being a tiger, challenges such as not having enough food to survive or to feed cubs. Displays such as this allow the guests, especially young visitors, to see what it's like to be a tiger, to experience the threats that tigers face in the wild. As they learn about tigers, they form connections, making them more likely to want to help save the species.

Signs help educate the public about animals, but it is far from the only method of education employed by AZA zoos and aquariums. Visitors can interact

with keeper staff and volunteers to learn about the animals and even experience animals in a hands-on manner. Many zoos have education ambassador or program animals. These are animals that are used to being handled safely and can be taken around the zoo by staff, giving visitors the opportunity to learn about, and sometimes even touch, the animals. These animals foster learning by increasing the amount of time that people are engaged with the animals, thus increasing the time for potential learning. Allowing visitors to see the animals close up also allows them to form greater connections, increasing the overall impact of the learning experience (AZA[3] 2015).

Zoos often have Discover Carts and activities for guests to interact with, allowing them to experience the zoo, and learn about the animals and conservation. These carts often contain animal artifacts such as fur, replicas of skulls or paw prints, or interactive activities. A survey conducted at the Woodland Park Zoo in Seattle, Washington found that 94% of visitors could identify one or more examples of the effects of climate change on animals after interacting with a cart activity about climate change (Owen 2012). Disney's Animal Kingdom created four flamingo specific interactive activities—Feeding Frenzy, Fancy Footwork, Flying Flamingos and Chic in Pink. These games mostly targeted young children, teaching them about the importance of clean water for flamingos and about how flamingos eat. These programs were shown to impact knowledge, attitudes and behavior. Children learned new things, like the fact that flamingos can fly, and had their attitudes and behaviors changed in a positive way by interacting with the activities and the staff running them (Lehnhardt 2012). These activities allow visitors, children in

particular, to understand a complex subject in a fun and exciting way, by playing games and experiencing nature. Though the child may only play the game for a few minutes, the knowledge and understanding gained from that experience is long lasting.

Zoos often offer classes as a way to further education. These classes range in length from only a few hours to entire academic semesters. John Ball Zoological Garden in Grand Rapids, Michigan offers summer discovery classes for children ages three to entering ninth grade. These classes last up to a week during the summer, allowing children to experience the zoo in a hands-on way. The camps cover topics such as conservation, animal care, and different aspects of animal behavior. The camps offer a unique way for children to learn about animals and nature, experiencing the world around them in a fun and informative way (JBZ 2015). Many zoos have similar summer camps, as well as evening classes that allow visitors to experience the zoo at night after all the guests have gone home. For many students, experiences such as these have a lasting impact, encouraging many students to pursue careers in the sciences, especially as it relates to the fields of zoology and conservation (Soller et al. 2013).

Some zoos can even bring the zoo to the classrooms. The Columbus Zoo and Aquarium offers the opportunity to bring the magic and learning of the zoo into a more-traditional classroom setting through interactive videoconferences. The Columbus Zoo and Aquarium use green-screen technology to videoconference with zoo staff and learn about the lives and behaviors of animals (Columbus Zoo and Aquarium 2015).

Rather than just bring the zoo to the school, through videoconferences or live animal presentations, some zoos actually have partnerships with area schools in which students attend school on zoo grounds. John Ball Zoological Garden in Grand Rapids, MI partners with Grand Rapids Public School to create Zoo School, an alternative sixth grade experience. Zoo School occurs in classrooms on the grounds of John Ball Zoo with a curriculum designed to heighten the students' awareness of the environment, develop leadership, stimulate creative thinking, promote intellectual growth and increase self-esteem (GRPS 2015). This unique program allows students to experience hands-on learning throughout the zoo while still meeting the core curriculum expectations. A great program for gifted students who are eager to learn, Zoo School offers special units on astronomy, zoology, forestry, chemistry, and physics, promoting independent learning and helping students appreciate and care about animals and the zoo.

Education programs such as discover carts, interactive activities, presentations by zookeepers, and summer classes can be found at most AZA zoos and aquariums. There are some zoological facilities, though, that go a step further with education. Once such institution is the Shedd Aquarium in Chicago, Illinois. Shedd Aquarium partners with middle schools in Chicago Public Schools to offer after school robotics programs. They sponsor an underwater robotics program that helps students learn first-hand skills in engineering and design while connecting them to the natural world and teaching them about the ocean. Students build remotely operated vehicles (ROVs) and compete in an international underwater robotics program sponsored by Marine Advanced Technology Education (MATE).

Shedd aquarium hosts the competition annually, with students building ROVs that complete that year's assigned task. Tasks focus on major environmental problems affecting the ocean, such as the 2011 task focused on containing and repairing oil spills, or a focus on underwater research projects in 2012 (Williams 2013). This program allows students to engage with aquatic ecosystems in a new and exciting way, and has even expanded to high school after a high success rate with middle school students. The Shedd Aquarium allows these students to experience the aquatic world in a positive way, teaching them not only about the dangers and conservation challenges facing aquatic ecosystems, but also about how they can make a difference.

While many zoos have education programs, other zoos are focused almost entirely on education. The Lincoln Children's Zoo in Lincoln, Nebraska is focused on first-hand learning and experience. Since its creation in 1965, the Lincoln Children's Zoo has been a place where visitors, both young and old, can touch, see, and do, learning firsthand through interactions with living things. As a smaller zoo, they have neither the space nor funds to expand or create expensive exhibits. Instead, they have a smaller collection of about 300 animals and work hard in all aspects of the zoo to engage children in nature. One major way in which they achieve this goal is through an interactive archeology display that encourages visitors to dig through the sand in search of replica bones, which can then be taken to "PaleoPals" for help identifying the bones and learning about the commonality of all species. With replica bones from multiple species, the children are able to form connections and recognize that most animals have similar skeletons (Smith 2009). Older guests start

to put the pieces together, connecting the bones to the larger skeletons, learning the science behind the way animals move. Lincoln Children's Zoo strives toward teaching the public about animals through first-hand experience, leading to a greater understanding and sensitivity for the natural world.

The educational experience of zoos goes beyond increasing the knowledge of visitors. Zoos help visitors, children in particular, learn socially and culturally as well as, intellectually. Many parents take their children to the zoo in order to promote caring for others, helping to grow their socio-political future in society (Webler et al. 2009). Children's experiences with live animals contribute to their understanding of compassion and empathy towards others. By learning about animals, visitors—especially young children—are able to think about others outside themselves, looking at other species and seeing how they can help them. Some zoos, such as Zoo Boise in Boise, Idaho, let visitors vote for which species they want their admission money to help conserve in the wild. As part of the zoo ticket, visitors are given a token to place in one of the three collection slots, corresponding to animals chosen by the zoo as the focus for that years' conservation efforts (Kaufman 2012). This helps the visitors connect the idea of conservation with the cost of their zoo admission and allows children to have a fun way to feel like their actions make a difference in global conservation. Zoos help children learn compassion and self-confidence, important social skills that will help them as they continue to grow and learn (Webler et al. 2009).

As the world moves into an ever-increasing digital age, zoos are able to expand their education through social media. Many zoos are on social media sites

such as Facebook and twitter. At these media sites, they are able to reach a large audience to share zoo news such as births in the zoo, special events, and conservation efforts. Social media allows zoos to connect people to animals, informing them about animals they may never have even heard of. Some zoos, such as Zoo Atlanta, in Atlanta, Georgia and John Ball Zoo in Grand Rapids, MI post links to keeper blogs, where people can see what it's like to be a zookeeper. Visitors can read the blogs to learn more about animals and about how zoos work. Social media can also connect people to the zoo, showing them how the animals are cared for, and giving visitors an insight into animal husbandry.

Zoos connect visitors to animals and the natural world, and educate the public about the animals in the zoo as well as the wild populations. Zoo signs and interactive activities play a major role in education, as do classes and demonstrations offered by the zoo. Zoos and aquariums help children learn important life lessons, and teach compassion, impressing upon them the impact that their actions have on animals and the ecosystem. Zoological facilities allow visitors to form connections with the animals so that they can understand the animals and grow to love them, leading to a greater desire to participate in conservation.

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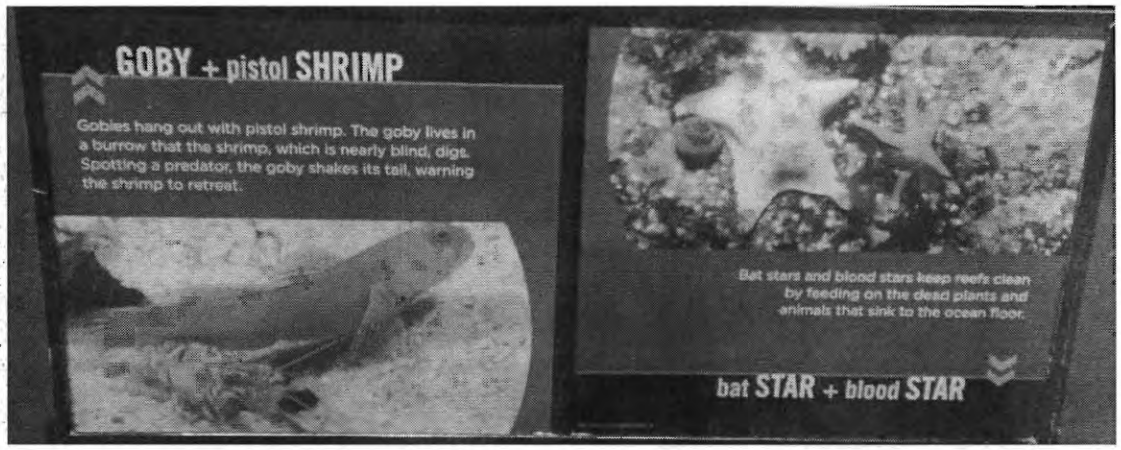

Figure 1: Informative sign found in the Oceans Building at the Indianapolis Zoo in Indianapolis, Indiana.

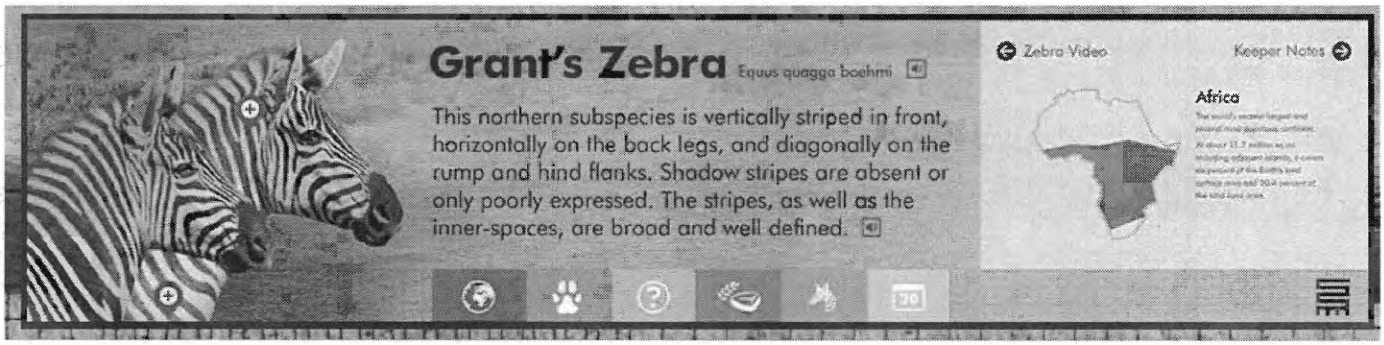

Figure 2: Interactive informative sign for Grant's Zebra at the San Francisco Zoo in San Francisco, California. Using a digital screen, the sign is interactive for the visitor (Crabtree 2015).

Figure 3: Sign at the Indianapolis Zoo Oceans Building show the visitors the impact of different actions on the ocean.

Figure 4: Tiger survival game at the Akron Zoo in Akron, Ohio (Wilson 2013).

The Importance of Zoos: Providing Exemplary Care through Animal Husbandry

Zoos help animals on a larger, worldwide scale through conservation and education, but they also provide care for the animals that live at the zoo. The animals rely on the exemplary care provided by the zookeeping staff. When discussing animal husbandry, it is important to understand what kinds of zoos are being described. Some people who believe that animals should not be kept in captivity for any reason are often against zoos. They believe that animals in captivity are deprived of certain liberties and rights that can only be achieved by living free and in the wild (Jamieson 1985) and often cite older or non-accredited institutions to make their point. Institutions that keep captive animals without proper care or accreditation further contribute to the negative view against zoos.

There are, unfortunately, a lot of places that keep exotic animals that are not accredited by reputable organizations. Many states and countries do not have very many restrictions on what kinds of animals can be owned as pets. As a result, many private citizens keep exotic animals as pets in substandard conditions for their own enjoyment. The exotic pet trade, which is highly unregulated, is a multi-billion dollar industry, second only to drugs and weapons on the black market (Animal Planet 2015, Humane Society of the United States 2010). These animals are kept by private citizens and are often used for pleasure or personal gain. They are rarely taken care of properly and are often in poor health. Roadside zoos consisting of privately owned animals give accredited zoos a bad name and ruin the integrity of the

zoological community. These "zoos" are not held to any standards, and when discussing the importance of zoos and their roles in animal husbandry are in no way applicable.

When discussing zoological facilities, I will focus on those zoos and aquariums that are accredited by the Association of Zoos and Aquariums (AZA). The AZA values superior animal husbandry practices meaning that the animal experiences good welfare, is well-nourished and safe, and able to express the natural behaviors and relationships of their species without being in unpleasant states such as fear, pain, or distress (AZA[4] 2015). These high standards and good quality care are maintained by the accreditation standards that are enforced by the AZA.

All zoos and aquariums undergo a detailed application process, as well as a multiple day on-site inspection and a thorough review by a team of experts in order to be accredited by the AZA. These standards are highly comprehensive and require that accredited institutions abide by all local, state, and federal animal laws as well as the standards and guidelines detailed by the AZA review board (AZA 2016). These guidelines include all aspects of zoo function and animal husbandry, from proper record keeping to veterinary care, to animal husbandry, facility upkeep, proper security and fencing, and cleanliness. The full standards for accreditation can be found on the AZA website where there are guidelines for animal enrichment; all aspects of veterinary care from quarantine to equipment; conservation; education; and finances explicitly detailed (AZA 2016). Once accredited, zoos and aquariums must continue to always maintain these high standards, as every facility must

undergo re-accreditation every five years. This serves to ensure that the zoos and aquariums that bear the AZA accreditation seal are always up to the high standards required of a respected zoological facility.

The AZA regulates all aspects of zoological function, indicating that the zoo in question is a reputable facility, providing excellent care for a variety of exotic animals, and a safe environment for visitors to experience animals first-hand and learn about the natural world. To ensure that the animals receive the best possible care, they produce Animal Care Manuals (ACMs). ACMs are a compilation of animal care and management knowledge assembled by experts. These experts are individuals from the species Taxon Advisory Group (TAG) and the Species Survival Plan (SSP), as well as veterinarians, biologists, nutritionists, behaviorists, researchers, and reproduction physiologists (AZA[5] 2015). These Animal Care Manuals are coordinated by the AZA animal welfare committee and managed by the Animal Conservation Office. Once completed, they are made publicly available so that anyone in charge of providing animal care can refer to the appropriate ACM.

These ACMs are extremely thorough and include information on topics such as the ambient environment, proper design of the habitat, containment of the animals, transport, the social environment needed, their nutritional needs, veterinary care, reproduction and behavior, as well as the policies concerning using the animals for programs or research (AZA Small Carnivore TAG 2009). These ACMs are very detailed providing AZA standards and policies for each section. For example, the ACM for otters details the optimal land/water ratios for the exhibits and the light schedules required by each otter species (AZA Small Carnivore TAG

2009). Each Animal Care Manual is created for a group of animals then divided within the manual by individual species requirements. For example, there are 17 species of penguins living in different habitats and climates. Many cold weather penguins require similar care, as do the warm weather penguin species so the manuals can be divided to provide the appropriate temperature ranges for each species. Emperor penguins (*Aptenodytes forsteri*) need an air temperature range of -6 to 0C (20 to 32F) while the warmer species of African (*Spheniscus demersus*), Magellanic (*Spheniscus magellanicus*) and Humboldt penguins (*Spheniscus humboldti*) require a range of 4.5 to 26.5C (40 to 80F). Antarctic and sub-Antarctic species must be housed in climate controlled indoor facilities while the temperate species can be successfully housed in either indoors or outdoors exhibits (AZA Penguin Taxon Advisory Group 2014).

Animal Care Manuals include information on enrichment and behavioral care of the species, as well as their physical care. Enrichment is an important aspect of animal husbandry. With the animals kept in captivity, their meals are prepared for them and the animals are not threatened by a lack of resources, competition, or predation, as they would be in the wild. Without these life stresses, the animals do not need to constantly be searching for food or protecting their territory. This can lead to inactivity in captive species. To counteract this and encourage natural behaviors, animal care staff provides enrichment for the animals in their care. Enrichment can take many forms. Environmental enrichment is when a stimulating environment in provided, encouraging the animals to demonstrate species-typical behavior, allowing them to exercise control or choice over the environment.

Stimulating natural behaviors in this way enhances the physical and mental well-being of the animals (National Zoo 2015).

Enrichment can take the form of adding new items to the exhibit or changing the exhibit design in some way to create something novel. Training sessions with keeper staff or participating in research are also forms of enrichment. Enrichment is simply anything new or different that will encourage natural behaviors from the animals. These could be novel objects; food, which is one of the most popular enrichment options; auditory stimulation such as sounds that might be heard in the wild; or olfactory stimulation like the scents of typical prey or predator species (National Zoo 2015).

Animals that don't receive enough enrichment can start to exhibit stereotypic behaviors. These are negative behaviors such as pacing, plucking feathers, or over grooming. These are repetitive, invariant behavior patterns that lack an obvious goal or function (Mason 1991). The use of enrichment improves mental health and reduces the occurrence of stereotypic behaviors. Numerous studies have shown that environmental enrichment alleviates stress in zoo animals. Social complexity is a large component of this, with animals being housed in appropriate social groups for the species, as well as mixed species enclosures (Carlstead and Shepherdson 2000). As appropriate social groupings for the species are essential, especially for animals with strong social structures such as primates or pachyderms, the main focus of variable enrichment is on inanimate enrichment such as food, objects, sights, sounds, and smells. For penguins, most of the day is spent in the water foraging for

food in the wild. In zoos, the penguins do not need to forage for most of their food. Therefore, a lot of their enrichment is centered on attracting the penguins to the water. This can be done with ice floats, live food, or slowly sinking feeding structures that will release food to the penguins when manipulated by swimming penguins (Larsson 2012). This encourages the penguins to swim in the water and search for food, preventing stereotypic behaviors and encouraging species-specific natural behaviors. It improves physical and mental health, making sure that all animals are well cared for in the zoo.

For many animals, zoos are necessary. Some animals are no longer capable of living in the wild. This could be due to injury or human necessity. Holly, a California Sea Lion (*Zalophus californianus*) at the Indianapolis Zoo in Indianapolis, Indiana, was in a bad situation. Unfortunately, sea lion strandings are becoming more frequent. Strandings are when a young sea lion pup appears abandoned and needs help. These commonly occur because of disruptions in the food chain, causing the parent to abandon the pup. Many of these sea lion pups can be rehabilitated by wildlife organizations and zookeepers sent by AZA zoos. Some, pups, however, are not successfully rehabilitated. This is what happened to Holly. Holly was not able to eat competitively with the other sea lions. This indicates a lack of competitive drive and would impair her ability to successfully hunt in the wild. Left on her own in the wild, Holly would not be able to survive. Instead of being left to this fate, she was taken in by the Indianapolis Zoo where she has lived "happily" for the last three years. At the Indianapolis Zoo she receives the food and proper medical care needed to grow up to be a healthy adult sea lion (Misencik 2015).

The Indianapolis Zoo gave Holly a new chance at life, and by living at the zoo, Holly is able to help her species. At the zoo, Holly, as well as all other zoo animals, serve as ambassadors to their species. Guests can visit the zoo and form a connection with the animals that live there. This allows the guests to form meaningful memories and learn about the animals. Once the guests see the animals and learn about them, they are more likely to care about the species and want to help protect them. More than 175 million people visit AZA accredited zoos and aquariums each year, learning from the animal ambassadors, and often leaving with a greater understanding and compassion for wildlife (Awesome Ocean 2015). Animas have the power to touch the hearts and minds of visitors, opening the doors to education, and inspiring people to protect animals and their environments.

AZA accredited facilities provide exemplary care to all animals in their collection. Rigorous guidelines and frequent inspections insure that all animals are given the best possible care at all times. Highly educated and trained keeper staff are constantly caring for and monitoring the physical and mental health of all animals in their care. The Association of Zoos and Aquariums insures that care is consistent and to the highest standards through the production of Animal Care Manuals, as well as strict guidelines for animal containment. Through the use of enrichment, animals are encouraged to exhibit natural behaviors, providing positive stimulation for strong mental health. Zoos also provide much-needed homes for rescued animals, allowing visitors to see those animals and learn from those experiences. The animals that live in the zoo are ambassadors for their species, helping to

educate the public about wildlife and the need for conservation. Zoos help protect animals and inspire people to care about their well-being.

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